

The Invention

The invention relates to a foundry binder system, which cures in the presence of gaseous sulfur dioxide and an oxidizing agent. The binder system contains an epoxy resin, and an ester of a fatty acid, and an oxidizing agent. The binder system does not contain any ethylenically unsaturated monomer or polymer (e.g. an acrylic monomer or polymer).

Because the binder is acrylate-free, all of the components of the binder can be sold and used in one package. This simplifies the customer's binder storage and handling operations.

It has been found that addition of the ester of the fatty acid to this acrylate-free binder provides foundry shapes that have better tensile strength development and humidity resistance than cores and molds made with binders containing an ethylenically unsaturated monomer or polymer. A cycloaliphatic epoxy resin is particularly preferred when the interest is obtaining cores with improved humidity resistance. The improvements in tensile strength development permits the foundry to use lower binder levels in the core-making process. This is beneficial in the casting of both light metal (e.g. aluminum) and ferrous parts.

The foundry binders are used for making foundry mixes. The foundry mixes are used to make foundry shapes, such as cores and molds, which are used to make metal castings.

DISCUSSION OF EXAMINER'S OFFICE ACTION

Claim Rejections - 35 USC § 112, second paragraph

The following is a quotation of the second paragraph of 35 U.S.C. §112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The terms "effective amount and parts" in claim 1 are relative terms which render the claims indefinite. The terms "effective amount and parts" are not defined by the claim, the specification does not provide a standard for

ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The term "parts" does not refer to a specific unit of measurement, such as weight or moles.

Claim 2 incorrectly depends upon itself so can not be understood. Claims 3-12 depend directly or indirectly upon claim 2.

Applicants' response

The language "effective amount" was deleted and specific amounts for the oxidizing agent were inserted.

The dependency of claim 2 was corrected.

The claims now indicate that all "parts" are "parts by weight". It does not matter what units are used to define the "parts by weight". It could be grams, kilograms, pounds, etc. What is important is the relative amounts of the various components and that they fall within the specified ranges. It should also be noted that the "parts by weight" are based upon "100 parts by weight" of binder.

Claim Rejections - 35 USC § 103 (a)

The following is a quotation of 35 U.S.C. §103(a), which forms the basis for all obviousness rejections Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Legal Standard of Obviousness

Graham V. John Deere, 383 U.S. 1, 148 U.S.P.Q. 459 (1966) outlined the approach that must be taken when determining whether an invention is obvious. In *Graham*, the Court stated that a patent may not be obtained if the subject matter would have been obvious at the time the invention was made to a person having ordinary skill in the art, but emphasized that nonobviousness must be determined in the light of inquiry, not quality. Approached in this light, §103 permits, when followed realistically, a more practical test of patentability. In accordance with *Graham*, three inquiries must be made in determining whether an invention is obvious:

- (1) The scope and content of the prior art are to be determined.
- (2) The differences between the prior art and the claims at issue are to be ascertained.
- (3) The level of ordinary skill in the pertinent art resolved.

Against this background, the obviousness or nonobviousness of the subject matter is determined. Secondary considerations, such as commercial success, long felt but unsolved needs, failure of others, etc., can be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

In conjunction with the interpreting 35 U.S.C. §103 under *Graham*, the initial burden is on the Examiner to provide some suggestion of the desirability of doing what the inventor did, i.e. the Examiner must establish a *prima facie* case of obviousness. To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention, or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.

To establish a *prima facie* case of obviousness, three basic criteria must be met:

1. There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings.
2. There must be a reasonable expectation of success.
3. The prior art reference (or references when combined) must teach or suggest all the claim limitations.

Claims 1-11 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Woodson (U.S. Patent 4,806,576) in view of Woodson (US 6,604,567).

Woodson discloses curable epoxy resin compositions comprising acid curable epoxy resins and a minor amount of an oxidizing agent which is capable of reacting with sulfur dioxide to form a catalyst for curing said epoxy resin. These curable epoxy resin compositions are useful in preparing formed, shaped, filled bodies such as abrasive articles, foundry cores and molds. Those mentioned include diglycidyl ethers of bisphenol A and the diglycidyl ethers of other bisphenol compounds such as bisphenol B, F, G and H.

Suitable epoxy resins for purposes of the cycloaliphatic group-containing epoxy resins are contemplated for use in the invention. Another class of epoxy resins useful in the patented invention is the novolacs, particularly the epoxy cresol and epoxy phenol novolacs. The epoxides are used in an amount of 30-50 pbw of the composition. A suitable oxidizing agent for use with the epoxy resins of the patented invention is cumene hydroperoxide. The sulfur dioxide used to cure the epoxy resins of the invention may be presented in a stream of a carrier gas. See col. 6, lines 12-62. The cold box process for foundry preparation is disclosed by patentee. The Woodson reference differs from applicant's invention in that it fails to teach the inclusion of a fatty acid ester. Woodson et al discloses a composition comprising a foundry resin, peroxide and acrylate component. Patentee indicates that an alkyl ester of a fatty acid may also be included in the compositions as a solvent. See the specification at col. 4, lines 28-50.

It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to incorporate the fatty acid esters of Woodson et al as an inert solvent in the foundry compositions of Woodson, since Woodson's use of the term "comprising" in the claims does not preclude the inclusion of additional components which do not materially effect the composition.

Applicants' response

Woodson '576 discloses foundry binders, which contain an epoxy resin and an oxidizing agent that cure in the presence of gaseous sulfur dioxide. Woodson discloses such binders that acrylate-containing and acrylate-free binders based upon epoxy resins. Woodson '576 does not teach or suggest the use of a of ester of a fatty acid;

On the other hand, Woodson '567 relates to foundry binders, which contain an epoxy resin and an oxidizing agent that cure in the presence of gaseous sulfur dioxide and are acrylate-containing. Applicants binders do not contain an acrylate, i.e. they are acrylate-free.

It is true that Woodson '567 discloses the use of solvents at column 4, lines 28- 50:

Optionally¹, a solvent or solvents may be added to reduce system viscosity or impart other properties to the binder system such as humidity resistance. Examples of solvents include aromatic hydrocarbon solvents, such as such as o-cresol, benzene, toluene, xylene, ethylbenzene, alkylated biphenyls and naphthalenes; reactive epoxide diluents, such as glycidyl ether; or an ester solvent, such as dioctyl adipate, esters derived from natural oils, e.g. butyl tallate, rapeseed methyl ester, and the like, or mixtures thereof. If a solvent is used, sufficient solvent should be used so that the resulting viscosity of the epoxy resin component is less than 1,000 centipoise, preferably less than 400 centipoise. Generally, however, the total amount of solvent is used in an amount of 0 to 25 weight percent based upon the total weight of the epoxy resin.

Although solvents are not required for the reactive diluent, they may be used. Typical solvents used are generally polar solvents, such as liquid dialkyl esters, e.g. dialkyl phthalate of the type disclosed in U. S. Pat. No. 3,905,934, and other dialkyl esters such as dimethyl glutarate, dimethyl succinate, dimethyl adipate, and mixtures thereof. Esters of fatty acids, particularly rapeseed methyl ester and butyl tallate, are also useful solvents. Suitable aromatic solvents are benzene, toluene, xylene, ethylbenzene, and mixtures thereof.

Woodson '567 indicates that the use of solvent in the acrylate-containing binder is optional rather than required. Furthermore, Woodson '567 discloses an entire "laundry list" of solvents and indicates that they are used to reduce the viscosity of the system or impart improved properties such as humidity resistance.

On the other hand, Applicants' acrylate-free binders must contain an ester of a fatty acid as a solvent, not one of the other numerous solvents listed in '567. And the ester of the fatty acid does not just reduce the viscosity of the binder. As the examples in the application show, the addition of the ester of the fatty acid clearly improves the humidity resistance of cores and molds made with the binder.

In view of this, Applicants submit that the combination of Woodson '576 and '567 does not teach or suggest an acrylate-free foundry binder that contains an epoxy resin, an oxidizing agent, and an ester of a fatty acid, which cures in the presence of gaseous sulfur dioxide and produces cores

¹ Underlining added for emphasis.

and molds with improved humidity resistance.

Double Patenting

The claims were rejected based upon the nonstatutory double patenting rejection. The Examiner indicated that a timely filed terminal disclaimer in compliance with 37 CFR 1.321 (c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Applicants' response

Although Applicants maintain their arguments that the pending claims are patentably distinct from those in U.S. patent application number 10/628,056 and U.S. Patent 6,604,567, they are submitting terminal disclaimers to eliminate this grounds for rejection in order to advance the prosecution. The submission of these terminal disclaimers should not be construed as an admission that the subject matter of this pending application is obviousness in view of U.S. patent application number 10/628,056 and U.S. Patent 6,604,567. See, for example, Quad Environmental Technologies Corp. v. Union Sanitary Dist., (Fed. Cir. 1991) and Ortho Pharmaceutical Corp. v. Smith, (Fed. Cir. 1992).

Conclusion

In view of the differences between Applicants' invention and the prior art, Applicants submit that claims 1-11 are not obvious under 35 U.S.C. §103 (a).

Furthermore, Applicants submit that their invention could only be derived from the references by the use of "hindsight", i.e. by knowing what Applicants' invention was in advance from Applicants' disclosure, and then *ex post facto* reconstructing Applicants' invention from the prior art after a thorough search. The prior art does not lead TPOSA to Applicants' invention.

In this regard, Applicants believe the discussion in *In re Kotzab*, 55 U.S.P.Q. 2d 1313 (Fed. Cir. 2000) at page 1317, mentioned previously, is relevant:

A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. See *Dembiczak*, 175 F.3d at 999, 50 USPQ2d at 1617. Close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher."² *Id.* (quoting *W.L. Gore & Assocs., Inc. v Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303,313 (Fed. Cir. 1983).

Applicants submit that the application is now in condition for allowance and respectfully request a notice to this effect. If the Examiner believes further explanation of Applicants' position is needed, Applicants' attorney will discuss this matter over the telephone or visit the Examiner personally if this may be useful.

Respectfully submitted,

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² Underlining added for emphasis.